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PRELIMINARY STUDIES

on

PREDACEOUS INSECT ENEMIES

of

Dendroctonus brevicomis

Northfork, Calif.
April, 12, '23

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Preliminary Studies of Insects Predaceous on Dendroctonus brevicomis.

Collecting of Infested Bark.

On Dec. 9, 1922 two gunny-sacks of yellow pine bark, containing large Dendroctonus brevicomis larvae, was collected near Chiloquin, Ore. in Area 11 of the S.Ore.-N.Calif. Control Project. This bark was taken from large standing trees in an area which had not yet been treated.

On Dec. 12, 1922 three sacks of yellow pine bark, containing large Dendroctonus brevicomis larvae was collected from the Shoner unit of the same project. This bark was from medium sized standing trees in an area which had been "treated" during the spring of 1922.

Treatment of Bark.

The bark was kept outdoors at Klamath Falls, Ore., until Dec. 19, when it was shipped to Berkeley, Calif. At Berkeley the bark was kept inside at room temperature. Part of the bark from each area was caged and the rest kept in the laboratory for use in making bark counts and watching the development of the Dendroctonus brevicomis broods and predators. Wooden cages, which would hold about 4 sq. ft. of bark, each were used. Five holes were bored in one side of each cage and large vials inserted from which the emergence could be collected.

Emergence of Dendroctonus brevicomis Adults

From Chilequin area:

The bark when caged (1-2-23) contained Dendroctonus brevicomis pupae and new adults.

Date	No.
1-11-23	3
13	2
15	40
16	54
17	42
18	53
19	44
20	29
23	21
25	1
26	6
27	4
29	1
Total	250

From the Shoner area:

The bark when caged (1-2-23) contained Dendroctonus brevicomis large larvae and pupae.

Date	No.
1-10-23	2
11	1
17	4
19	88
20	120
23	102
24	20
25	17
26	6
27	8
29	7
2- 1-23	3
Total	378

In both cases it was noted that the females were more abundant than males during the first period of emergence and less numerous during the last period.

Date

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1

Jan, 1923 Feb., 1923

Graph Showing
Emergence of D.b. Adults from Yellow Pine Bark.
(at Room Temperature)

Number Emerged

120
110
100
90
80
70
60
50
40
30
20
10
0

Shoner Area Total Emergence 378
Chiloquin " " " 280

H.W. Webb, Glen Ridge, N.J.

—Negative 2.

H.

Two clerid larvae but no other predators were found in the vials. The clerids probably escaped from the cage as larvae, and the T.v.c.* did not have time to develop before the writer left Berkeley, 2-15-23.

Bark Examination

From 12-28-22 to 1-17-23, 7.8 sq. ft. of bark from the Shoner area and 3 sq. ft. of bark from the Chiloquin area was shaved up with a knife and the contents examined. The result was as follows:

		clerid larvae	T.n.c. larvae
Shoner	7.8 sq.ft. of bark	4	6
Chiloquin	3 " " " "	16	11

The number of Dendroctonus brevicomis found was not counted.

Notes on T.v.c. larvae

On Jan. 17-1923 a large T.v.c. larva was found in the bark and placed on another piece of Dendroctonus brevicomis infested bark. It was observed to chew its way into the bark very readily. Two hours later the bark was cut open and the ostomid larva was found in the tunnel of a Dendroctonus brevicomis adult which it had evidently just devoured. In a number of instances T.v.c. larvae were found in a Dendroctonus brevicomis tunnel near the remains of a Dendroctonus brevicomis adult. Another ostomid larva was guided into a hole in the bark containing a Dendroctonus brevicomis adult, after 10 minutes the bark was cut open and the partially devoured Dendroctonus brevicomis and the ostomid larva were found together.

(* See list of Insects with Abbreviations, in Appendix)

All of the ostomid larvae which were found uninjured, while making the bark counts, were put in a pint fruit jar with Dendroctonus brevicomis infested bark. Feb. 10-23, this bark was examined and it was found that only three of the ostomids were still alive. Two of the larvae were found in one cell in the bark, and one was partly eaten, evidently by the other.

Feb. 16, this same bark was examined again and only two ostomids remained, one having been eaten by the other two.

Notes on Thanasimus nigriventris

All of the T.n. larvae found up until 1-12-23 were either in Dendroctonus brevicomis tunnels or burrowing their way between the bark layers from one Dendroctonus brevicomis tunnel to another. Actual feeding was not observed.

On Jan. 12-23, 11 T.n. prepupal larvae were found in one piece of bark 4" square. These larvae were separated quite easily into two groups. Four of the number were smaller than the others, blue-purple in color and had short setae. The other seven were larger, reddish purple and had longer setae. These were reared separately in the belief that they might be different species. Both groups developed into T.nigriventris however. It is barely possible that those differences may be sex differences, but the writer has been unable to work this out as yet.

The following gives the rate of development for each group:

Larger forms.

1-12-23 - 2 prepupal larvae in pupal cells put in glass vials with bark.

1-23-23 - 1st pupa observed

2-4-23 - 1st Adult emerged

2-12-23 - 2d " "

Smaller forms

1-12-23,- 2 prepupal larvae in pupal cells - put in glass vials with bark.

1-23-23 - 1st pupa observed was injured while being examined and died.

2-5-23 - 2d larva had become a pupa.

2-21-23 - 2d larva had changed to adult form.

The pupal cells were formed in the middle bark layers of a size and shape to fit the prepupal larva. The cells were lined with a white silky substance.

Jan. 20-23 a T.n. adult was found running about on a table in the laboratory. As the only fresh bark in the laboratory was that which was brought down by the writer from the Klamath Falls region, this T.n. adult and the others found later were assumed to have emerged from this bark.

All the T.n. adults found were put in a one-quart glass jar with small slabs of bark, and supplied with Dendroctonus brevicomis adults for food. An accurate count was kept of the number of Dendroctonus brevicomis eaten.

Jan. 24, 2 T.n. adults were found on a window of the laboratory. They began to feed as soon as they were put in the jar with the Dendroctonus brevicomis adults. Feeding was observed many times. The clerid moved about rapidly over the

bark and when it encountered a Dendroctonus brevicomis adult it seized the victim with its four anterior legs, balancing itself on its two posterior legs and the tip of its abdomen. Regardless of the position of the Dendroctonus brevicomis when seized the clerid always turned it so that their ventrums were opposed and the heads in the same direction. The point of attack was usually either at the juncture of the head and thorac or at the juncture of the thorac and abdomen. The amount of the Dendroctonus brevicomis actually consumed varied from a small part of the soft internals to practically all of the body except the more heavily chitinized parts of the exoskeleton. Usually only the internals were eaten. In one case noted the clerid severed the abdomen from the rest of the body and ate the contents as the feeding from a small cup. (Plate I, Fig. 1)

Jan. 25-1923, 3 more T.n. were found and put in the jar. Copulation was also observed on this date. The male mounted the female so as to bring its (the males) head to the caudal end of the females pronotum, the abdomen of the female being clasped by the two anterior pairs of legs of the male. The process lasted only about 30 seconds . Copulation was observed a number of times, later on, and the only variation of the above was in the length of time used, which was often greater.

Jan. 26 - A clerid was observed attempting copulation with a Dendroctonus brevicomis. 3 attempts were made.

Jan. 27 - Three more T.n. adults were found on the laboratory window. They were put in the jar with the others.

Feb. 2 - Two rhaphidia were found on the window casing and were put in the jar with the T.n.

Feb. 13 - It was found that the clerids had killed the two rhaphidia and eaten most of them. One clerid was found attached to the partially eaten abdomen of one of the rhaphidia.

Feb. 15 - The writer was transferred to Northfork, Cal. The adult T.n. were moved to the laboratory at Northfork, and the feeding continued until Mar. 12, 1923 when only three clerids remained alive.

The following data summarizes this experiment:

No. of T.n.	Date caged	No. of T.n.	Date of death
1	1-20-23		
2	1-24-23		
3	1-25-23		
3	1-27-23		
		2	2-1-23
		2	2-5-23
		2	3-10-23

Experiment closed 3-12-23, with 3 clerids still alive.

Average life of adult - 40 days.
Total "clerid-days" -360 "
Total No. of D.b. eaten-240
No. of D.b. eaten by each clerid 26.66
" " " " per "clerid-day" -- .666

March 11 - 12 clerid eggs were found on a slab of bark in the cage. They must have been layed by 3 females, which is an average of four eggs each. This is probably far below the normal number as conditions were not very favorable, due to close quarters. Very little attempt was made to conceal the eggs as most of them were found on the flat bark surface. (Plate I, Fig. 2.)

The eggs were pink in color with a white circular band near the smaller end; length .05 - .07", diameter at largest point, .014 - .018", shape, subcylindrical with a slightly curved axis and a taper toward each end, but more pronounced toward one end than the other; no surface markings (see photo).

The eggs hatched some time before Apr. 4, while the writer was on a field trip. This gives an incubation period of about three weeks. This is probably a longer period than normal as the temperature in the laboratory was not kept up over night.

Preliminary Feeding Studies(Cont'd)

at Northfork, Calif.

Sugar Pine Series.

On Feb. 20-1923, A. W. Wagner collected a number of predaceous and other insects from beneath the bark of a D.m. infested sugar pine, found near Northfork. These insects were brought in alive in a can of moist frass. This material was looked over by the writer and 3 T.v.c. larvae, 6 T.n. larvae, 2 Doretaphrus oregonensis adults and 1 Tenebroides sp.adult were saved for use in the feeding experiments described in the following.

1. One large T.v.c. larva was put in a 1000 x 300 min. vial with 10 D.m. and 2 D.v. adults. They were well packed in with frass and small pieces of bark and kept moist to imitate conditions under the bark where they were found.

When examined 2-8-23 it was found that all of the D.m. and D.v. adults had been killed and partly eaten. Their remains were taken out and 10 D.b. adults were added.

By 2-14-23 7 of these D.b. adults had been killed and the experiment was closed.

Summary - A total of 19 dendroctonus adults were killed by one large T.v.c. larva in 21 days. A "beetle-day" consumption of .90.

2. Feb. 21-23 one T.v.c. larva was put in a frass filled vial with 10 large D.v. larvae and 1 D.m. adult.

When examined on Mar. 8, it was found that all of the D.v. larvae and the D.m. adult had been killed. It was not

possible to get definite results with scolytid larvae as one could not tell whether the larvae were all actually attacked or if they died from injuries caused by the close quarters.

Actual attacks of the T.v.c. larva on the D.v. larvae were observed in a few cases. The T.v.c. seized the victim with its large mandibles at any convenient point on the body, closing and opening them until the body-wall was punctured. Some of the internals were then eaten; usually only very little of them.

3. Feb. 21, One medium large T.v.c. larva was put in a frass filled vial with 5 D.b. adults.

Mar. 10 - It was found that the 5 D.b. adults had been killed and partly eaten. Five more D.b. adults were added.

Mar. 13 - The 5 D.b. added Mar. 10, had been killed and partly eaten so 5 more were added.

Mar. 20 - Four of the 5 D.b. added Mar. 13 had been killed and partly eaten and the experiment was closed.

Summary - A total of 14 D.b. adults were killed by one medium large T.v.c. larva in 27 days. A "beetle-day" consumption of .52.

4. Feb. 21 - Three T.n. larvae were put in a frass filled vial with 5 D.m. larvae and 5 D.v.larvae.

Mar. 8 - Two of the clerids and 4 of the scolytid larvae were still alive. Six of the scolytid larvae had been killed and 3 of them showed signs of being attacked. The other three were all dried up.

5. Feb. 21 - Three T.m. larvae were put in a frass filled vial with 10 D.v. larvae and 5 D.m. adults.

Mar. 8 - Only one clerid larva was still alive. It had formed a pupal cell in a small piece of bark.

Four of the D.m. adults had been killed and partly eaten, and a number of the larvae had been killed by the clerid larva. As it was not known how long the other two clerids had been dead no "beetle-day" consumption figures could be given. It is evident however, that the clerid larvae are much less effective than the T.v.c. larvae.

6. Feb. 23 - Two adult Deretophrus oregonensis were put in a vial with 4 D.m. and 7 D.b. adults. Bark and frass was also put in the vial.

Mar. 8 - Two D.m. and 2 D.b. adults had been eaten.

Apr. 5 - Three more D.b. had been eaten.

Summary - Seven scolytid adults were killed and partly eaten by 2 D.o. adults in 40 days. A "beetle-day" consumption of .08.

7. Mar. 16 - One adult Tenebroides sp. was put in a vial with 3 D.b. adults.

Mar. 21 - Two of the D.b. had been eaten.

A "beetle-day" consumption of .4.

Yellow Pine Series

On Feb. 24, E. Morrow, A. Wagner and the writer felled a large D.b. infested yellow pine on a slope east of Northfork. The tree had been attacked in the fall of 1922 and now contained a good brood of D.b. principally large larvae with some pupae and new adults. Bark sections were taken at five foot intervals for rearing and bark counts and the writer collected a number of T.v.c.* larvae and adults, T.n. larvae, C.c.p. adults, A.l. larvae and adults and 1 rhaphidia larva. All of these forms were found under the bark except the T.v.c. adults which were found in the outer bark crevices. This material was brought in alive in a can of frass and kept separated so that they would not injure each other. The T.v.c. are especially voracious and will readily attack other insects or each other if not kept in separate vials.

These insects were used in the following experiments:

1. Feb. 28 - Two adult ostomids were put in a 2 quart glass jar with 15 D.b. adults, small slabs of bark were put in the jar.

Mar. 12 - Thirteen of the D.b. had been eaten.

Five T.v.c. adults and 30 D.b. adults were added.

Mar. 21 - The 7 T.v.c. adults had eaten 25 D.b. adults since Mar. 12.

Summary - A total of 38 D.b. adults were eaten by the 7 T.v.c. adults in 78 "beetle-days". The "beetle-day consumption was .5.

(* See Appendix)

The T.v.c. adults usually feed in bark crevices out of sight but in a few instances they were observed while feeding in the open. In attacking, the ostemid seizes the adult D.b. with its mandibles at any convenient point, and crushes the exoskeleton. The soft internals are then consumed and often the exoskeleton as well leaving only the wings, elytra, legs and more heavily chitinized head parts. The victim is held entirely with the mandibles which can easily crush any part of the exoskeleton. The scolytid attacked is usually forced into a bark crevice or against some object so that it can be more easily held during the feeding process. (Plate 2)

2. Feb. 26 - Two cucujid adults were put in a one quart glass jar partly filled with bark, with 14 D.b. adults.

Mar. 5 - Nine of the D.b. had been eaten.

Eighteen D.b. adults were added.

Mar. 21 - Thirteen more D.b. adults had been eaten since Mar. 5.

Summary - The 2 C.c.p. ate 22 D.b. adults in 18 days. A "beetle-day" consumption of .61.

3. Mar. 10 - Three A.l. larvae were put in a small glass vial with 3 D.b. larvae. The vial was well packed with moist frass to make conditions as favorable as possible for the A.l. larvae.

On Mar. 21 - 11 days later, it was found that 2 of the D.b. larvae were still alive and the other larva showed no sign of attack except a very small cut.

4. Mar. 13 - Nine A.l. adults were put in a frass filled vial with 8 D.b. adults and 6 D.b. larvae.

On Mar. 21 none of the D.b. adults or larvae showed any sign of attack except 1 of the larvae which had a small cut.

5. Mar. 10 - One rhaphidia larva was put in a frass filled vial with 4 D.b. larvae.

Mar. 21 - The 4 D.b. larvae were still alive and uninjured.

Tabulated Summary of Feeding Studies.

Predaceous species	♀ - Stage	Scolytid ♀ - Stage	"Beetle-day" consumptio
1 T.v.c.	larval	7D.b.10D.m.2D.v.	Adult .90
1 "	"	14 D.b.	" .52
7 "	adult	38 "	" .50
T.n.	larval	no figures	
9 "	adult	240 D.b.	" .66
2 C.c.p.	adult	22 D.b.	" .61
1 Tenebroides sp.	"	2 D.b.	" .40
8 D.o.	"	5 D.b. 2 D.m.	" .08
9 A.l.	"	8 D.b.	" .00
1 Rhaphidia	larval	4 D.b.	larval .00

SUMMARY.

The writer realizes that the studies so far completed are to limited in extent and nature to be considered final. Caged insects often act in an abnormal manner and many false conclusions have been reached thru their use. Still, such experiments are often necessary, and of value, when supplemented by field studies and observations, especially in getting comparative date for insects with similar habits. The experiments already completed, the rudimentary, have been of some value in developing the technic for such studies and in "feeling out" a practically new field.

The following points have been suggested by the preceding studies and by a review of the field notes which have been summarized in this paper.

1. The ostomid, T.v.c. appears to be the most effective of any of the predators on D.b.

It is about equal to the clerid, T.n., its nearest competitor, in abundance (according to bark counts by the writer at Berkeley and by Wagner at Northfork).

The adults are probably a little less effective than the T.n. adults.

The larvae are by far the most effective of any of the larvae tested in the feeding experiments.

2. Cucujus clavipes var. puniceous may prove to be a predator of some value since the adults were found to have a high "beetle-day" consumption, .61, which is exceeded only by T.n. adults.

3. The writer believes that Aulonium longum is of less value as a predator than the records would indicate. (See summary of field notes in Appendix). The two records giving accounts of actual feeding of an A.l. on living D.b. are reliable but probably exceptional. In the feeding experiments, the writer was unable to get either the A.l. adults or larvae to feed on any of the stages of D.b., D.m. or D.v. These experiments were carefully conducted over a period of a month and a half under conditions as favorable as those in which the ostomids, clerids and cucujids were found to feed readily.

4. Since there is no record of a Rhaphidia sp. being found feeding on D.b. and since neither the caged adults nor larvae show any tendency to feed on this scolytid there is some reason to question the standing of this neuroptera as a predator of D.b.

5. Finally, these studies indicate that T.v.c. and T.n., at least, have possibilities in the line of natural control of D.b., which make it worth while to continue this investigation. At present the aim should be to work out in detail the habits and life history of any of the predators which show possibilities of being of value.

APPENDIX.

List of Insects Used in the Preceding Studies with Abbreviations and Determinations.

Predators.

Species	Family	Abbreviation	Stage	Det. By-
Thanasimus nigriventris	- Cleridae	- T.n.-	Adult -	Van Dyke
" "			Larval-	H. Person-by rearing to adult stage
Temnochila virescens var. chlorodia	- Ostomidae	T.v.c.	Adult	Fisher
Temnochila sp.	- "	"	Larval	Boving (Det. by H.P. as T.v.c. by rearing to adult stage)
Aulonium longum	- Colydiidae	A.l.	Adult	Fisher
Aulonium sp.	- "	"	Larval	Boving
Cucujus clavipes var. puniceus	- Cucujidae	C.c.p.	Adult	Fisher
Deretaphrus oregonensis	- ?	D.o.	Adult	Fisher
Tenebroides sp.	- ?		Adult	"
Rhaphidia sp.	- Rhaphididae		Adult	None
" "	- Scolytid		Larval	"
Dendroctonus brevicomis	- Scolytidae	D.b.	Adult	Hopkins
" monticolae	- "	D.m.	"	"
" valens	-	D.v.	"	"

Records of Important Predacious Enemies of Western Scolytids.

Included in the Families Cleridae, Ostomidae (Trogositidae), Colydiidae.

Northfork, Calif. Forest Insect Field Station.

U.S.Hopk.#	Name	Habits	Location	Coll.	Date Coll.	Id.	Date.
		From Pinus jeffreyi					
15704c	Clerus sphegeus	adults in Ips galleries	Yos.,J.P. Park,Cal.	6-2-18	Fisher	1-18-19	
13330b	Trogosita sp.	" under bark of Ips oregona tree	Sequoia Forest,Cal.	J.M.	7-22-17	none	
15735b	" "	adults in ips galleries	Yos.,J.P. Park,Cal.	8-6-18	Fisher	1-18-19	
15704b	Aulonium longum	" " " "	" " " "	6-2-18	"	" " "	
		From Pinus lambertiana					
15700a	Clerus sphegeus	adult on D.m. tree	Yos.Park,J.P. Cal.	5-4-18	Fisher	1-28-19	
15760c	Clerus sphegeus	" " " " "	Three R. Cal.	J.M.	4-28-18	none	
14235e	Trogosita viridicyanea	larvae from ips tree	Ashland,F.K. Ore.	11-11-16	Fisher	5-14-17	
15765c	" "	adult from D.m. tree	Three R. Cal.	J.M.	6-20-18	none	
		From Pinus muricata					
13204f	Clerid?	larvae in ips galleries	Inverness, Cal.	F.K.	1-18-15	none	
13204g	"	" " " "	"	"	" " "	"	
		From Pinus murrayana					
15725a	Clerus sp.	adults from D.m. and Ips tree	Lake Tenaya, Cal.	F.K.	11-23-17	Fisher 1-18-19	
		From Pinus ponderosa					
12587b	Clerid?	8 larvae from 14" x 8" piece of bark from D.b. tree	Ashland, Ore.	J.M.	12-7-14	none	
*13316e	"	feeding on new adults of D. valens	Colestin, Ore.	J.P.	5-14-17	"	
12317f	Clerus. nigriventris	adults from D.b. tree	Ashland, Ore.	F.K.&J.M.	8-13-17	"	
13356e	Clerid?	larvae in D.b. tree	" "	A.W.	1-10-18	"	
13361g	Clerid?	" " " " bark	" "	7-13-17	Fisher	3-24-19	
13388e	Enoclerus sp.	" from D.b. tree	" "	1-30-19	Boving	2-24-19	

U.S.Hopk.#--Name------Habits------Location--Coll.--Date Coll--Id. & Date.

From Pinus ponderosa (Cont'd.)

f4260ex	Clerus sphegeus	adults on ips tree	Ashland, Ore.	F.K.	7-26-16	Fisher 9-30-16
14264l	Clerid?	" from D.b. tree	" "	"	" " "	none
*15743b	Clerus sphegeus	" " " "	Yos.Park Cal.	J.P.	5-1-18	Fisher 1-8-19
15746g	Clerid?	" " D.m. "	Three R. Cal.	J.M.	4-23-18	none
15761g	"	larvae in D.b. tree	" "	A.W.	8-5-18	"
15766b	Clerus sphegeus	adult from " "	" " " "	" "	"	
15776b	Clerid?	larvae in D.b. "	Ashland Ore.	" "	2-4-19	"
15783e	Clerus sphegeus	adult on " " "	" " " "		3-7-19	"
16200b	Thanasimus nigriventris	" " " "	" " "	J.M.	5-25 to 7-8-19	H.P. 3-7-23
*16200bl	"	" found feedong on D.b. adults	" "		6-25 to 7-9-19	" " " "
16201b	Clerus sphegeus?	adults from D.b.tree	" "	Ser.	7-1-19	none
16201u	Clerid?	" " " " " "	"	" " "		"
16218dx	"	larvae in D.m. tunnels	" "	"	10-24-19	"
13361f	Temnochila v.-chlorodia	adults and larvae in D.b. infested bark	" "	S&W	7-13-17	Fisher 3-24-19
13388a	Trogosita virescens	larvae on D.b. tree	" "	A.W.	1-30-19	Boving 2-24-19
15746f	Trogositid?	adults from D.b., D.m. tree	Three R. Cal.	J.M.	4-23-18	none
15750b	Trogosita sp	adults from D.b.tree	Jenny Cr. Ore.	J.P.	10-30-18	Fisher 1-18-19
15761e	Trogositid?	" " " "	Three R. Cal.	A.W.	8-5-18	none
15762c	Trogosita sp.	" " " "	" "	J.M.	" " "	"
15776a	" virescens	larvae in D.b. tree	Ashland, Ore.	A.W.	2-4-19	"
15797b	Trogositid?	adult on " "	Coeur D'alene Rv. Id.		6-16-19	"
16200e	Temnochila v.-chlorodia	" from " bark	Ashland, Ore.	J.M.	7-9-19	H.P. 3-7-23
16200o	Temnochila v-chlorodia	larvae " " tree	" "	"	7-25-19	" " 2-7-23
16200n	Trogosita virescens	" " " "	" "	" " " "		Boving 7-26-20
16201c	Trogosita sp.	adults from D.b.tree	" "	Ser.	7- 1-19	none
16201v	" viridicyanea	" " " " " "	" " " "	" " "		"

U.S.Hopk.#	Name	Habits	Location	Coll.	Date, Coll.	Id. & Date
		Pinus ponderosa (Cont'd.)				
16218f	Trogosita virescens	adults from D.m. log	Ashland, Ore.	Ser -	7-11-19	none
12587d	Aulonium longum	" in D.b. galleries	"	J.M.	12-7 -14	Fisher 10-24-16
*12317d	" "	" feeding on D.b. adults	"	F.K. J.M.	8-13-17	none
13359e	" "	under bark of Ips confusus tree	"	A.W.	1-10-18	"
*13361d	" "	adults followed D.b. " into end of gallery and ate them	"	S.& W.	7-13-17	Fisher 3-24-19
13388b	" sp	larvae on D.b. tree	"	A.W.	1-30-19	Boving 2-24-19
14251e	Aulonium longum	adults in D.b. ips galleries	"	J.M.	3-25-16	none
14260c	" "	" under bark of ips tree	"	F.K.	7-26-16	Fisher 9-30-16
14260d	" "	[illegible] D.b. tree	"	"	" " "	" " "
15745f	" "	" from D.b., D.m. tree	Three R. Cal.	J.M.	4-29-18	none
15756a	" "	" " " tree	"	"	4-22-18	"
15761e	" "	" " " "	"	A.W.	" " "	"
15783b	" "	" " " "	Ashland Ore.	"	3-17-19	"
16200e	" "	" " " bark	" "	J.M.	7- 9-19	H.P-3-7-23
		Pseudotsuga taxifolia				
15752e	Clerid?	larvae in D.pseudo-tree	Mistletoe, Ore.	Ser-	8-27-18	none
15754e	"	" " " "	"	"	" " "	"
		Miscellaneous				
1422d	Clerid?	larvae in galleries of Pityophthorus pubipennis on Q.californica	Ashland, Ore.	J.M.	10-15-15	none
7-3-16	Thanasimus nigriventris	newly formed adults in pupal cells of D.b. infested P.ponderosa	Klamath Falls, Ore.	F.K.		none
*8-7-?	Aulonium longum	larvae observed feeding on living D.b.pupae	Yreka, Cal.			"
13356c	Cucujus clavipes	adults found under bark of var.puniceus	Ashland, Ore.	Wagner		"
15743e	" " "	" "Dib.infested Yellow Pine	Yos.Park Calif.	J.P.	Fisher	1-8-19

Plate 1

Fig.1 Two Thanasimus nigriventris adults with the remains of some of the D.brevicomis upon which they had been feeding. (Enlarged 1 3/4 X)

Fig.2 Two eggs of T.nigriventris on yellow pine bark. (Enlarged 5 1/2 X)

Note - All photos by J.M.Miller, assisted by the writer.

Plate 2.

Fig.1 and 2. Ostomids.(Temnochila virescens var.chlorodia♀,caught while feeding on D.brevicomis adults. (Slightly less than natural size.)